SCIENTIFIC PROBLEMS FOR SCIENTISM

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Abstract: *Five areas are examined in which scientism -- the view that the cosmos is all that exists, and that it is entirely explicable by natural law -- has shown itself to be problematic even from the perspective of scientific evidence.*

One of the major opponents of biblical Christianity in the West since the rise of modern science has been scientism, the claim that -- to use the words of Carl Sagan -- "the cosmos is all that is, or ever was, or ever will be."[1]

This view has been given various names, depending on the nuance in mind. As an absolutizing of science to be the only means to true knowledge, it is called *scientism*.[2] As the claim that matter-energy is the ultimate reality, it is called *materialism*.[3] As the belief that everything can be explained by the operation of purely natural forces without miracles at all, it is called *naturalism*.[4] As the view that all the complex organization in our universe has developed by unguided processes working within natural laws, it is called *evolutionism*.[5] Though there is some divergence among these views, for simplicity in this paper we will lump them together and call them scientism.

Scientism has had significant influence beyond the circle of its own proponents. It changed the definition of what constitutes true scholarship.[6] In every academic field it led to the rise of models which banished the supernatural from their own territory. Some examples are:

1. Liberal biblical criticism, e.g., the JEDP theory, that the first five books of the OT were not written by Moses, an eyewitness of miracles narrated in them, but by anonymous authors and editors living centuries later and reworking myths and legendary material;[7]

2. Darwinian evolution, the claim that all the diversity of life on earth can be explained by the operation of random variation and survival of the fittest;[8]

3. Marxism, the ideology that human political history is totally economics -- in particular, the struggle of various social classes for domination;[9]

4. Freudianism, the claim that human behavior is a result of non-logical, non-moral forces acting upon or within the human psyche.[10]

These models, in turn, have provided ammunition for groups with very different worldviews than scientism, which have typically used it to shoot at biblical Christianity. Muslims, for instance, use liberal biblical criticism to discredit the Bible and keep their people from seriously considering its message.[11] Liberal Christendom has adopted most of the results of scientism, turned

many away from the faith, all the while trying to retain some place for spirituality and religion.[12] Liberation theology has borrowed its insights from Marxism.[13] The New Age movement has taken over evolution and given it a pantheistic or polytheistic flavor.[14] Even within evangelical Christendom, there has been some heavy influence from non-biblical psychologizing.[15]

Here we propose to look at five areas in which scientism has made large and influential claims, and to show that such claims face serious scientific problems -- not just theological objections as would convince only committed Christians. In this way, I trust, we may be strengthened ourselves, and become more effective in helping those around us who may be attracted by scientism or by its ideas which have penetrated into other circles. The five areas we shall consider are: (1) prediction; (2) continuity; (3) mindlessness; (4) eternality; and (5) locality.

1. Prediction

The French mathematician Pierre Simon de Laplace (1749-1827) was one of the early proponents of the idea that the universe is a vast machine which can be explained totally by the operation of natural laws. His popular work *Exposition of the System of the World* (1796) proposed that the sun and earth had arisen from a large gas cloud. Shortly thereafter, Laplace was reportedly introduced to Napoleon, who asked him what place this left for God. "Sire," he replied, "I have no need for that hypothesis."[16]

Laplace and others claimed that since the world operated totally on the basis of natural laws, it would in principle be possible (once these laws were discovered) to calculate the entire future merely by knowing the position and velocity of all the particles in the universe at one time. Let us call this the *Laplacean program* for prediction. To the extent that this project was substantially fulfilled, it would be a powerful apologetic for the worldview of scientism. In fact, the mere attraction of the idea itself, given the astonishing advances science was making, convinced many that scientism was true even without this test.

The Laplacean program, however, has always been in trouble computationally. Consider, first of all, the question of how big a computer would be needed to make this calculation. Even assuming that nothing but particles and forces exist, one would need to be able to calculate the movement of each particle in the universe under the influence of every force acting on it. There appear to be at least 10^{80} elementary particles which would need to be tracked by the computer.[17] Each of these particles exerts at least one kind of force on all the other particles within the range of that force, and the range for two of these forces -- the electromagnetic and gravitational -- is effectively infinite.[18] The number of calculations involved for each time-step is thus astronomically larger than even the number of atoms and electrons in the universe!

A far more economical strategy would be to build a universe just like ours and watch what it does.[19] But to do this, we need to know exactly what our universe has in the way of particles and forces. Then we need to get this information set up in the form of a parallel universe. Then we need to place all the particles in their proper locations with the right velocities. Then we need to figure out how to make this universe run much faster than ours does so it can get ahead of ours

and be of some use for predicting the future. The project looks like something God might do, but nothing we will ever be capable of!

Two basic discoveries of this century -- quantum phenomena in the 1920s and chaotic behavior more recently -- only serve to bury this project even deeper under its own arrogance.

The strange world of the very small with its quantum phenomena has frightened both Christians and non-Christians.[20] The problem with which we are here concerned, however, involves our inability to locate the position and velocity of the small elementary particles exactly. This is more than just a matter of limited precision in measurement, which afflicts all human activity. The fact is that the nature of light and matter is such that to measure position more and more accurately, we have to use light of shorter and shorter wavelength, and so larger and larger energies. Eventually we cross a threshold where the energy of the light we are using disrupts the very thing we are trying to measure. To measure a particle's position very accurately, we lose information on its velocity; to measure velocity, we lose information on position. The upshot is that we cannot even set up our parallel universe exactly in the first place, and (even if we could) we would have to be satisfied with statistical predictions of what will occur rather than specific details.

Much has been made in the past few years of so-called chaotic phenomena.[21] Nature often does not behave as simply as we would like. Though scientists have tended to think that small errors in measurement will only produce small effects in prediction, it is now clear that this is not the case in many situations. For instance, in the complex world of weather -- the interaction between our air (with its dust and water vapor) and the sun, land and oceans -- a small change will not always remain small, but may grow so large that prediction is impossible. The situation is called the *butterfly effect*, because it appears that the disturbance produced in the air by the flight of a single butterfly might sometimes make a big difference in the weather a continent away and a week later!

Thus the Laplacean program is dead. Even if the universe were a closed system of cause and effect, it would not be possible to prove this by making predictions of what must happen. The Christian worldview, by contrast, features the intervention of a prayer-answering God, a common experience among believers and one which has often functioned to bring unbelievers to salvation. More publicly testable is the phenomenon of fulfilled prophecy, which has rightly been an important part of Christian evidences for most of church history.[22]

2. Continuity

Scientism has shown a distinct antagonism toward (and fear of) discontinuities in nature -- apparent gaps, breaks and singularities. Doubtless this is because such phenomena smack of divine intervention and have regularly been used by Christians as evidence of such. This antagonism shows up quite strongly in both cosmology and biology, though we will save our comments about cosmology for the section “Eternality,” below.

One of the major attractions of Darwin's evolutionary proposal (for himself and many of his followers) was that it pictured all change as virtually continuous, being produced by the natural selection of innumerable small variations. The discontinuities between present varieties of living things was seen as the result of slow, relatively continuous processes acting over long periods of time. The violent reaction of biologists in the 1940's to Goldschmidt's "hopeful monster" hypothesis (with its large mutational jumps) illustrates the powerful emotions raised by even a naturalistic attack on continuity.[23] But neither the fossil record nor the testable abilities of the Darwinian mechanism really suggest that this assumption of continuity fits reality.

Though it is "the trade secret of paleontology," it is true that there are no transitional sequences of fossils between upper levels of the biological classification scheme.[24] Darwin felt the force of this objection, one of the strongest presented in his own time. He proposed that the fossil record was woefully incomplete, but that -- should it be possible to fill it in sometime in the future -- these transitions would surely show up.

The 135 years of collecting since Darwin wrote his *Origin of Species* have turned up an enormous number of fossils from all over the earth -- we now have something like 200 million fossils catalogued in museums.[25] Still no transitional fossils! Already by the 1930's, this lack of transitions was troubling enough to require evolutionists to postulate that all significant evolution takes place in small, isolated groups of plants or animals, so that we would hardly be likely to find the transition fossils. We will say a bit more about this under our discussion on mechanism, below. Enough here to note that the major events of evolution are missing from the record. Certainly the fossil record is no argument for continuity!

Another fossil problem is the shape of the fossil record. Textbooks commonly picture the fossils as showing a "tree of life," beginning with a single trunk early in earth's history (representing the primitive single-celled organisms), followed by the major branches into plants and animals. On each of these branches in turn, we have smaller branches and then twigs going off to form the living things which exist today. Ignoring the fact that most of the branching junctions on this tree are hypothetical, the tree has the wrong shape. If Darwinian evolution is true, it should begin with one species, which would gradually mutate into more species. Then the species should become divergent enough to form genera, the genera eventually forming families, and so on upwards in the biological classification scheme to phyla, the major body plans among the plants and animals. Instead, the fossil record is upside-down! Virtually all the animal phyla appear to have formed in a very brief period called the "Cambrian explosion" right near the beginning of multi-celled life, and none (or one) have formed since.[26] This certainly looks like a discontinuity!

The Darwinian mechanism -- mutation and natural selection -- is very attractive not only because it avoids discontinuity but because at first sight it seems to be obviously true. If variation occurs in all populations of plants and animals (and it does), and if those variations which help an organism better to survive in a given environment are more likely to be passed on to the next generation than their competitors (they are), then how could we avoid getting better and better plants and animals in the course of time? This appears to be true, and suggests that Darwin's discovery of natural selection really has located a mechanism by which organisms adapt to

changing environments.

But Darwinists typically jump from here (*microevolution*) right to so-called amoeba-to-man evolution (*macroevolution*), without taking seriously the question of whether a mechanism for small-scale change will really produce large scale changes. Since extrapolation from one size-scale to another in other sciences often breaks down (e.g., weather to climate, or Newtonian physics to relativity), we need to look at the data to see whether or not it does here also, rather than just plugging in our worldview to solve the question.

When we look at the data, we find trouble. Even if mutation and selection can change (a few) dark and (many) light colored moths into (a few) light and (many) dark ones, it doesn't follow that it can produce moths in the first place. Attempts to simulate mutation and natural selection on a computer do not work.[27] Apparently random processes cannot be expected to produce high levels of organization even in the time and space provided by our whole universe.[28] This is a problem not only for producing the first living things from non-living,[29] but also for all the really substantial changes thereafter. These latter changes require fully functional pathways from one working system to another, like converting a Volkswagen into a Cadillac without taking it off the road. How do we get legs to change to wings with all the intermediates not only fully functional, but good competitors with everything else in their ecological niche? How convert scales to feathers? Or a two-chambered heart to a three- and then a four-chambered one? Similar problems exist for explaining the simplest functional forms of various biochemical systems necessary to photosynthesis, locomotion, vision, and respiration.[30] A great deal of hand-waving takes the place of evidence or even specific proposals for pathways here.

Creationists are regularly sneered at for their "God of the gaps" explanation, which was frequently plugged into places later explained by natural law. The same procedure, however, is regularly used by scientism in the form of a "natural law of the gaps." Just as Bible-believers have sometimes inserted miracles anywhere in science there appears to be a gap, proponents of scientism will in the same places (1) suggest an unknown natural law, (2) propose that there is no gap but only missing data, or (3) invoke the semi-miraculous powers of mutation and natural selection to bridge the chasm. But science has not succeeded in filling in these gaps. On the contrary, it appears that several of them are gaps in reality.

3. Mindlessness

For scientism, the only kind of minds that exist in the universe are those which have developed in the course of its history by mutation and natural selection. Some think this has happened only once -- here on earth -- but the more popular view is that life and intelligence may be rather common out there.[31] In either case, the beginning of the universe as we know it, and of life, are mindless. Both Darwin[32] and recently Dawkins[33] try to explain reality without recourse to a mind behind the universe. Darwin's work, in fact, has been widely hailed as destroying Paley's argument that design implies a designing mind behind it.[34]

But the existence of design in inanimate nature is devastating to this program, and so is the

question of where the complex organization came from that characterizes even the simplest living things.

In non-living things -- like the basic forces of the universe, the nature of the chemical elements and compounds, the frequency of various environments in the universe -- there is no mutation and natural selection to produce the observed order. How is it, then, that our universe is not only fit for life (if it weren't, we wouldn't be here), but that this fit involves a level of "fine-tuning" that takes one's breath away?

For example, the precise fit between the four basic physical forces in our universe is staggering. The strongest force known is the strong nuclear interaction, 100 times stronger than the electromagnetic force. Electromagnetism, in turn, is a thousand times stronger than the weak nuclear force, and the weak force 10 million billion billion billion (10^{34}) times stronger than gravity. These forces span a range in strength of nearly 40 powers of ten, yet small changes in the strength of any one of them would render the universe uninhabitable.

If the strong force were only 5% weaker, stars wouldn't burn; if it were 5% stronger, stars would explode. If electromagnetism were a few percent stronger or weaker, the electrons around an atom would be held too strongly or too weakly; in either case, there would be insufficient chemical bonding for life molecules. If the weak force were a few percent stronger or weaker, there would be no elements heavier than hydrogen and helium outside stars, thus no planets to live on and no chemicals to support life. If gravity were slightly weaker, stars would never get hot enough to turn on their nuclear furnaces and no heavy elements would be formed; if slightly stronger, the stars would be too hot, burn up too quickly, and provide no stable environment for life. A precise balance between gravity and the expansion speed of the universe is necessary for it to form galaxies and stars. The positive and negative charges of the electromagnetic force must cancel out almost exactly so that gravity can dominate at astronomical distances and provide habitable planets around efficient stars.[35]

The uniqueness of many chemical elements and the compounds they form is also striking, but too involved for discussion here.[36]

Though science (and science fiction) writers regularly picture a universe with lots of earth-like planets and intelligent beings living on them, the right conditions for life now look like they may be unique to earth in the entire universe.[37] Certainly we live in a universe that would look designed to an unbiased observer.

Proponents of scientism speak rather glibly about a naturalistic origin of life through a series of chemical reactions in the atmosphere, oceans and tidal ponds of the early earth. But when actual details and scenarios are examined (as Robert Shapiro does in his book *Origins*), and when actual numbers are supplied for the probabilities, the whole idea moves from the plausible to the ludicrous.[38] The time and opportunity are not there -- not on earth, not on a thousand earths, not in a thousand universes. As William Dembski has said, "the probabilistic resources" of the universe are insufficient for something like this to have taken place.[39]

But a mind can construct a level of order that would never happen by chance. That's why an archaeologist can look at a chipped stone and immediately discern it is an arrowhead, the work of a mind and not of the random chipping and cracking that nature produces. Yet the amount of information contained in the exact placement of the chips that make the stone an arrowhead is minuscule compared with the information stored in the simplest DNA molecule. Thus, the claim that the universe was initially mindless is merely the proposal of a worldview and not the conclusion of a scientific research program. The enormous amount of information stored in DNA points rather in the opposite direction.

4. Eternality

In scientism, the universe must somehow be eternal. Proponents of scientism generally realize that there is no rational alternative within their system to postulating that the universe (in some sense) has always existed. Recall Sagan's remark that "the cosmos... is all that ever was." The recent triumph of the big bang cosmology in its no-bounce form badly undercuts this claim. Let's see how this is so.[40]

In the last century, atheists typically opted for the visible universe being eternal and basically static. They were aware that no known laws would allow the stars to burn forever, but no one knew how to make them burn as long as they obviously had. They knew that gravity was only attractive, so that a static universe would have to have some force holding the stars apart or it would eventually collapse. Yet the problem of a universe with a beginning was not squarely faced.

As we learned more about atoms and their nuclei in this (20^{th}) century, it was realized that mature stars burn by converting hydrogen into helium. Life-spans were calculated for the various star-sizes, and it became apparent that the visible universe had not been around forever, but only for some billions or tens of billions of years. A long time, no doubt, but pretty short when compared to infinity.

About the same time, it gradually became apparent that the universe was expanding -- distances between ourselves and all galaxies but the local ones were increasing. Einstein could already have predicted this in 1915 from his general theory of relativity, but the atmosphere of scientism at the time was so much against this that he added a "fudge factor" to make the universe static. It wasn't until Slipher and Hubble measured the recession rates of various galaxies that the fact had to be faced. We live in a universe in which the galaxies are moving apart.

But if the universe is getting bigger, it must once have been smaller. Extrapolating this trend backward into the past would point to a universe which was very small and very hot at a beginning some billions of years ago. The Catholic astronomer George Lemaitre made such a proposal in the late twenties (the earliest version of the big-bang theory), and the history of cosmology since then has been a frantic attempt to avoid this beginning in spite of mounting evidence in its favor.

George Gamow, for instance, sought to change the beginning into a bounce. In his view, the universe from eternity past had existed as a mass of thin hydrogen gas which was collapsing under its own gravity until just a few billion years ago, when it became sufficiently dense and hot to rebound. Other cosmologists decided this single-bounce universe was too contrived and opted for an oscillating universe which bounced every hundred billion years or so. Both models restored the idea of an eternal universe and were the popular versions of the big-bang theory until quite recently.

Meanwhile Fred Hoyle, Thomas Gold and Herman Bondi tried another tack to rescue the universe from a beginning. They proposed an infinite, eternal universe with stars running down and galaxies moving apart, but each place always looking about the same because new matter was continually popping into existence to fill up the gaps and provide new star-fuel. They called this the "steady-state" universe.

New discoveries in astronomy put pressure on the steady-state theory first. The model predicted that objects such as galaxies and quasars should be uniformly distributed throughout space (so long as the volume being considered was big enough to average out random fluctuations). But in the 60s and 70s it became apparent that there were far more objects long ago (at great distances) than there are now. Then the radio radiation predicted by the big-bang theory was discovered, and for most astronomers, this put the last nail in the steady-state's coffin. The universe was hotter and denser in the past than it is now.

Since the early 70s, the competition has been between various forms of the big-bang theory. Did the universe begin at the big bang? Or was the big bang just a bounce from a previous contracting phase of its history? One problem was that a universe which collapsed to the densities and temperatures that characterize the big bang would not bounce but become a black-hole. And if the theory of general relativity is true, then space and time (as well as matter and energy) came into existence at the big bang. Thus the big bang itself appears to be a creation event!

Stephen Hawking attempts to avoid a creator at this point by postulating that the universe popped into existence without a cause![41] His suggestion is so at odds with the basic methods of science that he should be ashamed to hold such a theory and simultaneously sneer at Christians for their supernaturalism. We at least propose an adequate cause for the universe. Thus the apparent non-eternality of our universe is a serious scientific problem for scientism.

5. Locality

In a universe with matter-energy as the ultimate reality, one would naturally expect the interactions between particles to be local, one bumping against the other. This is how the ancient Greek atomists viewed it. When Newton proposed that forces operated at a distance by means of fields, the materialists of his time were very skeptical; it seemed to them to smack of spiritism.[42] Even after physicists got used to Newton's idea of fields, the basic view was that two particles interacted by direct (local) contact of each with the field produced by the other. The

rise of quantum mechanics has put serious pressure on this idea, and it now appears that there is something like instantaneous interaction between widely separated locations.

Some of the strangeness of quantum phenomena in this regard can be seen in the famous two-slit experiment and its relation to the controversy over whether light is particle or wave.[43] In an otherwise darkened room, light is sent out from a very small source at one end of the room and detected by a photographic plate on the wall at the other end. With no intervening screens, the plate will just fog up rather uniformly, which either waves or particles might do. If a screen with a single narrow slit is set up a few feet in front of the wall, the plate when developed will show one strongly exposed line which is an image of the slit, but with a pattern of dimmer lines around it, a phenomenon called "diffraction." These extra lines are not something particles would make, but this is how waves operate. When the screen is made with two parallel slits in it, the pattern changes to a whole series of nearly equally bright lines (called an "interference pattern") rather than just two images of the slits. Again, what we would expect from waves. So light is a wave, right?

Now comes quantum mechanics. If we turn down the intensity of the light to a very low level, it will not only take a long time for this two-slit interference pattern to form, but if we look at the plate we will see that the pattern forms by an increasing number of dots on the plate which gradually form this pattern, rather than by the whole interference pattern just getting clearer as more light arrives. Apparently, the photographic plate is absorbing the light at a particular spot each time (rather than all over at once), as though the light was arriving in particles instead of waves! But particles wouldn't form interference patterns, and waves wouldn't be absorbed at single points. What is happening? Are we dealing with some kind of dispersed, non-local particles?

We're not finished yet. If one turns down the intensity of the light so much that only one "light-particle" would be in flight from the source to the plate at any time, we still get our interference pattern! But if we block up one of the slits, or even try to measure which slit the particle went through, the pattern won't form! The same results are obtained if we run the experiment using electrons rather than light. Somehow the particle "knows" about the other slit, whether you think it only goes through one of them or both at once! There is something decidedly non-local about matter and light.

This non-locality can extend to great distances, as we see more clearly in Einstein's attempts to circumvent the uncertainty principle. Einstein proposed measuring two identical particles which had just separated from one another in a decay event. Since they are identical, they will be moving at equal speeds in opposite directions. So if we measure the speed of one and the position of the other, we indirectly learn the speed and position of both, violating quantum uncertainty. And if we measure the two when they are far enough apart, neither will know what kind of measurement we did on the other, since information cannot be conveyed faster than the speed of light. But a version of this experiment has recently been done, and Einstein was wrong. Somehow the one particle did "know" what was done to the other, even though there was not time for light to travel from one to the other![44]

Theoretical physicist John Bell has also shown that, if the quantum facts are correct -- no matter what sort of theory we use to explain them -- reality must be non-local in the sense that mutual influences can take place at rates exceeding the speed of light.[45] Here again, we arrive at a scientific result that is counter-intuitive to scientism, but consistent with a God who is everywhere present and need not wait for light to bring information from some distant source.

Conclusions

In this paper we have looked at five areas where the view of reality proposed by scientism is challenged by actual scientific observation. We called these areas prediction, continuity, mindlessness, eternality and locality.

First, we saw that the predictive program of Laplace which, if successful, would have effectively demonstrated the truth of scientism, has collapsed. The structure of nature is such that there appears to be no way from within the universe to make accurate predictions beyond rather trivial ones that are either broad-stroke, short-term or local. By contrast, the biblical evidence of fulfilled prophecy[22] (though not discussed here) points beyond this universe to the transcendent God of the Bible.

Second, we saw that the attempt of scientism to explain reality without recourse to discontinuity in nature faces serious empirical challenge. We looked in some detail at gaps in the fossil record and at the inadequacy of the Darwinian mechanism, both of which point to real discontinuity in the history of life. We might also have mentioned the origin of the universe and the origin of life as further examples. All these are consistent with a theism in which God sometimes reveals himself by intervention in nature.

Third, we saw that Darwin and Dawkins' proposal of no mind behind the universe is no better than its ability to explain such apparent design as is known to exist. Though this proposal is widely hailed as successful in biological evolution -- which we dispute in our discussion under "continuity," above -- it founders in explaining evidence of design in inanimate nature, both the structure of the universe as a whole and the specific "fine-tuning" of our own environment here on earth. Rather, these features are just the sort of thing we would expect from a Designer like the God of the Bible.

Fourth, we saw that the necessity for scientism to have a eternal universe has stumbled over the evidence that the cosmos began at the big bang some billions of years ago. Those who espouse a materialist worldview must now retreat to a universe popping into existence without cause, thus abandoning one of the primary axioms of science. Or they must propose that our universe is just part of a much larger universe of which we can never have any evidence, thus abandoning their claimed empirical superiority over Christianity. The believer's faith in the unseen is at least based on objective evidence of divine revelation.

Lastly, we saw that the program of scientism to have a universe of merely local causation --

where particles and fields only interact by contact -- seems to be doomed by developments in quantum research. The apparently instantaneous interaction at a distance observed in Aspect's experiment seems more consistent with an omnipresent, omniscient God than with a universe of mindless particles and fields.

This should encourage us as Christians not to fear the forces of secularism which seem so powerful and daunting in the media and education today. The God of the Bible really exists. He has not left himself without testimony. We can trust him to keep his promises. He will not abandon us to our enemies. May we seek to study and proclaim the truth, both as it is revealed in God's word, the Bible, and in God's world, the universe.

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3. "materialism," in *Webster's Third Unabridged*, def. 1a, p. 1392; *Webster's Ninth Collegiate*, def. 1a, p. 753, gives: "a theory that physical matter is the only or fundamental reality and that all being and processes and phenomena can be explained as manifestations or results of matter."

4. "naturalism," *Webster's Third Unabridged*, def. 2, p. 1507; *Webster's Ninth Collegiate*, def. 2, p. 780, gives: "a theory denying that an event or object has a supernatural significance; specif. the doctrine that scientific laws are adequate to account for all phenomena."

5. "evolutionism," *Webster's Third Unabridged*, def. 2, p. 789, is somewhat broader than what I have in mind here: "adherence to or belief in evolution, esp. of living things." I am concerned with the specifically naturalistic version of this as promoted by Richard Dawkins, *The Blind Watchmaker* (New York: Norton, 1986) and critiqued by Phillip E. Johnson in his paper "The Religion of the Blind Watchmaker," *Perspectives on Science and Christian Faith* 45 (March, 1993): 46-48.

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12. Hugh Ross Mackintosh, *Types of Modern Theology: Schleiermacher to Barth* (London: Nisbet, 1937); William Hordern, *A Layman's Guide to Modern Theology* (New York: Macmillan, 1955), ch. 4. For evangelical responses, see J. Gresham Machen, *Christianity and Liberalism* (1923; reprint Grand Rapids: Eerdmans, 1946); Carl F. H. Henry, ed., *Christian Faith and Modern Theology* (New York: Channel, 1964).

13. Gustavo Gutierrez, *A Theology of Liberation* (Maryknoll, NY: Orbis, 1973); J. Andrew Kirk, *Liberation Theology* (Atlanta: John Knox, 1979). For a recent evangelical response, see Humberto Belli and Ronald H. Nash, *Beyond Liberation Theology* (Grand Rapids: Baker, 1992).

14. e.g., see Marilyn Ferguson, *The Aquarian Conspiracy: Personal and Social Transformation in Our Time* (Los Angeles: Tarcher/St. Martins, 1987), pp. 157-167; Benjamin Creme, *Maitreya's Mission* (Amsterdam: Share International, 1986), pp. 151-197. For evangelical responses, see Douglas R. Groothuis, *Confronting the New Age* (Downers Grove, IL: InterVarsity, 1988); Vishal Mangalwadi, *When the New Age Gets Old* (Downers Grove, IL: InterVarsity, 1992).

15. William Kirk Kilpatrick, *Psychological Seduction* (Nashville: Nelson, 1983); Martin and Deidre Bobgan, *Psychoheresy* (Santa Barbara, CA: Eastgate, 1987); Gary R. Collins, *Can You Trust Psychology?* (Downers Grove, IL: InterVarsity, 1988).

16. The Napoleon/Laplace story is mentioned in several places, e.g., James Hastings, ed., *Encyclopaedia of Religion and Ethics* (1909), 2:178a.

17. See D. W. Sciama, *Modern Cosmology* (Cambridge: Cambridge University Press, 1971), pp. 124-125; P. C. W. Davies, *Accidental Universe* (Cambridge: Cambridge University Press, 1982), pp. 59, 76-77.

18. The range of a force is the distance within which the force has a significant effect. For the strong nuclear force, this distance is roughly the diameter of an neutron or proton (10^{-13} cm). For the weak nuclear force it is about one hundred times smaller. For the electromagnetic and gravitational forces, the strength decreases with the square of the distance from the source instead of having a rather sharp cutoff as the other two forces do. Thus their range is sometimes spoken of as infinite, though obviously their significant effect becomes negligible at finite distances. In any case, the range of the electromagnetic and gravitational forces is much longer than those of the two nuclear forces.

19. This would replace the many parts in the computer to represent each particle with just one -- the particle itself.

20. P. C. W. Davies and J. R. Brown, eds., *The Ghost in the Atom: A Discussion of the Mysteries of Quantum Physics* (Cambridge: Cambridge University Press, 1986); Nick Herbert, *Quantum Reality: Beyond the New Physics* (Garden City, NY: Anchor/Doubleday, 1985); Hugh Ross, *The Creator and the Cosmos* (Colorado Springs, CO: NavPress, 1993), ch. 12.

21. James Gleick, *Chaos: Making a New Science* (New York: Viking, 1987).

22. A survey of biblical prophecies, both those already fulfilled and others still future is given by J. Barton Payne, *Encyclopedia of Biblical Prophecy: The Complete Guide to Scriptural Predictions and Their Fulfillment* (New York: Harper and Row, 1973). Books specifically dealing with fulfilled prophecy as evidence for the truth of Christianity are Robert C. Newman, ed., *Evidence of Prophecy* (Hatfield, PA: IBRI, 1990) and John Warwick Montgomery, ed., *Evidence for Faith* (Dallas: Probe/Word, 1991), part 4.

23. Phillip E. Johnson, *Darwin on Trial*, 2nd ed. (Downers Grove, IL: InterVarsity, 1993), pp. 37-41.

24. The phrase is Stephen Jay Gould's in *Natural History* 86, no. 5 (1977): 14. See also Charles Darwin, *Origin of Species*, ch. 10; George Gaylord Simpson, *The Major Features of Evolution* (New York: Simon and Schuster, 1953), p. 360; Steven M. Stanley, *Macroevolution: Patterns and Process* (New York: Freeman, 1979), p. 82.

25. D. Raup, "Conflicts Between Darwin and Paleontology," *Field Museum Bulletin* (Jan 79): 22.

26. Stephen Jay Gould, in "The Power of This View of Life," *Natural History* (June 94): 8, says: "All but one phylum arose in a single geological whoosh, within some five million years or so, at the dawn of Cambrian times, 530 million years ago..." See also Jeffrey S. Levinton, "The Big Bang of Animal Evolution," *Scientific American* (Nov 92): 84-91; Richard A. Kerr, "Evolution's Big Bang Gets Even Bigger," *Science* (3 Sept 93): 1274-75.

27. Murray Eden, "Inadequacies of Neo-Darwinian Evolution as a Scientific Theory," in Paul S. Moorhead and Martin M. Kaplan, eds., *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution* (1967; reprint, New York: Alan R. Liss, 1985); Mark A. Ludwig, *Computer Viruses, Artificial Life and Evolution* (Tucson, AZ: American Eagle, 1993).

28. William A. Dembski, "On the Very Possibility of Intelligent Design," in J. P. Moreland, ed., *The Creation Hypothesis: Scientific Evidence for an Intelligent Designer* (Downers Grove, IL: InterVarsity, 1994), pp. 113-138, followed up by the actual evidence in the succeeding chapters. More detail is given in William A. Dembski, "The Incompleteness of Scientific Naturalism," in John Buell and Virginia Hearn, eds., *Darwinism: Science or Philosophy?* (Richardson, TX: Foundation for Thought and Ethics, 1994), pp. 79-94.

29. Fred Hoyle compares this to the likelihood of a tornado assembling an airplane from parts in a junkyard! "Hoyle on Evolution," *Nature* (12 Nov 81): 105. See my discussion in Robert C. Newman, "Self-Reproducing Automata and the Origin of Life," *Perspectives on Science and Christian Faith* 40 (1988): 24-31 and responses in *PSCF* 41 (1989):26-28 and *PSCF* 42 (1990): 113-14. See also Ludwig item in note 27 above.

30. Michael J. Behe, "Molecular Machines: Experimental Support for the Design Hypothesis," paper presented at the national meeting of the American Scientific Affiliation, Seattle, 1993; see also Michael J. Behe, "Experimental Support for Regarding Functional Classes of Proteins to Be Highly Isolated from Each Other," in Buell and Hearn, *Darwinism: Science or Philosophy?*, pp. 60-71.

31. Carl Sagan, *The Cosmic Connection: An Extraterrestrial Perspective* (New York: Dell, 1973); Edward Regis, Jr., ed., *The Extraterrestrials: Science and Alien Intelligence* (Cambridge: Cambridge University Press, 1985); G. Siegfried Kutter, *The Universe and Life: Origins and Evolution* (Boston: Jones and Bartlett, 1987); Thomas Michael

Corwin and Dale Wachowiak, *The Universe: From Chaos to Consciousness* (Orlando, FL: Harcourt Brace Jovanovich, 1989). Some evangelical perspective is provided in the August 1977 issue of the *SCP Journal* and in Hugh Ross' *The Creator and the Cosmos* (Colorado Springs, CO: NavPress, 1993).

32. See Johnson, *Darwin on Trial*, 2nd ed., p. 33, and Dawkins, *The Blind Watchmaker*, p. 249.

33. Dawkins, *The Blind Watchmaker*.

34. Dawkins, *The Blind Watchmaker*, pp. 4-6, 37; John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (New York: Oxford University Press, 1986), pp. 76-87.

35. Hugh Ross, *The Fingerprint of God*, 2nd ed. (Orange, CA: Promise, 1991), ch. 12; Ross, *The Creator and Cosmos* (Colorado Springs, CO: NavPress, 1993), ch. 14; see also P. C. Davies, *The Accidental Universe* (Cambridge: Cambridge University Press, 1982) and Barrow and Tipler, *Anthropic Cosmological Principle*.

36. See Barrow and Tipler, *Anthropic Cosmological Principle*, ch. 8. Much of this material was originally collected in Lawrence J. Henderson, *The Fitness of the Environment* (1913; reprint, Magnolia, MA: Peter Smith, 1970).

37. Hugh Ross has compiled this material in his *Creator and the Cosmos*, ch. 15. More detail and documentation is provided in his *Fingerprint of God*, ch. 14.

38. Robert Shapiro, *Origins: A Skeptic's Guide to the Creation of Life on Earth* (New York: Summit Books, 1986). See also Charles B. Thaxton, Walter L. Bradley and Roger L. Olsen, *The Mystery of Life's Origin: Reassessing Current Theories* (1984; reprint, Dallas: Lewis and Stanley, 1992).

39. See note 28.

40. Robert C. Newman, "The Evidence of Cosmology," in John Warwick Montgomery, ed., *Evidence for Faith* (Dallas: Probe/Word, 1991), pp. 71-91; Ross, *Fingerprint of God*, chs. 6-10; and Ross, *Creator and the Cosmos*, chs. 3-11.

41. Stephen W. Hawking, *A Brief History of Time: From the Big Bang to Black Holes* (Toronto: Bantam, 1988), ch. 8.

42. A. Rupert Hall, *From Galileo to Newton 1630-1720* (London: Collins, 1963), p. 312; Nancy R. Pearcey and Charles B. Thaxton, *The Soul of Science: Christian Faith and Natural Philosophy* (Wheaton, IL: Crossway, 1994), pp. 73, 89-90.

43. J. C. Polkinghorne, *The Quantum World* (Princeton: Princeton University Press, 1984), pp. 34ff; Davies and Brown, *Ghost in the Atom*, pp. 7-13.

44. Davies and Brown, *Ghost in the Atom*, pp. 13-17. I have simplified the discussion considerably.

45. Nick Herbert, *Quantum Reality*, pp. 50-52.